UNIVERSITI SAINS MALAYSIA

Second Semester Examination
2010/2011 Academic Session

April/May 2011

EAP 412/4 – Environmental Studies
[Pengajian Alam Sekitar]

Duration: 3 hours
Masa : 3 jam

Please check that this examination paper consists of **NINE (9)** pages of printed material including appendices before you begin the examination.
[*Sila pastikan bahawa kertas peperiksaan ini mengandungi* ***SEMBILAN (9)*** *muka surat yang bercetak termasuk lampiran sebelum anda memulakan peperiksaan ini.*]

Instructions : This paper contains **SIX (6)** questions. Answer **FIVE (5)** questions**.**
[***Arahan*** *: Kertas ini mengandungi* ***ENAM (6)*** *soalan. Jawab* ***LIMA (5)*** *soalan.*

You may answer the question either in Bahasa Malaysia or English.
[*Anda dibenarkan menjawab soalan sama ada dalam Bahasa Malaysia atau Bahasa Inggeris*].

All questions **MUST BE** answered on a new page.
[*Semua soalan* ***MESTILAH*** *dijawab pada muka surat baru*].

In the event of any discrepancies, the English version shall be used.
[*Sekiranya terdapat percanggahan pada soalan peperiksaan, versi Bahasa Inggeris akan diguna pakai*].

1. (a) Lists all major air pollutants monitored within the Continuous Air Quality Monitoring Network in Malaysia. Give volumetric as well as gravimetric value for each of them which are equivalent to API 100.

[5 marks]

(b) Illustrate the relationships between geometric diameters and number of particulate pollutants in a volume of air. Specify the modal differences according to sizes.

[4 marks]

(c) Explain the formation of ozone within the ambient air.

[5 marks]

(d) The needs for modelling of air pollutants have become very important in Malaysia. If a new project is proposed in Bukit Tambun to develop a new industrial areas which covers about 300 ha. (3 km^2), explain the reason why modelling of air pollutants need to be carried out.

[6 marks]

2. (a) Calculate concentrations of sulphur dioxide (SO_2) (in μgm^{-3}) at ground level, 5 kilometer downwind during <u>cloudy</u> weather condition emitted from a stack of a coal fired power station (stack height = 100 m). The coal burning rate is 5000 tonne/day. The sulphur content is 1.4%. Effective release height is 214 m, and windspeed at stack height is 11.2 ms^{-1}.

[7 marks]

(b) In order to estimate practical or dynamic adsorption capacity, one needs to know the adsorption phenomenon at equilibrium. Briefly, explain how to study the adsorption phenomenon at equilibrium.

[6 marks]

(c) A 2100-Megawatt Manjung power plant, located in Seri Manjung, Perak, is designed to burn coal having a 1.25% sulphur content. The flowrate of flue gas exit from this power plant is 765 kmol/min (at 413 K and 1 atm) and the flue gas contains 957 ppm SO_2. This flue gas will be treated using limestone scrubber which consists of 95% $CaCO_3$ and 5% inert material. Assume the following overall stoichiometry is applied for limestone:

$CaCO_3 + SO_2 + 2H_2O \rightarrow CaSO_3.2H_2O + CO_2$

(AW: Ca = 40 kg/mol; C = 12 kg/mol; O = 16 kg/mol;

S = 32 kg/mol; H = 1 kg/mol)

If a limestone excess of 15% will be used to remove 90% SO_2, calculate limestone feed rate (in tonne/day) required.

[7 marks]

3. (a) Briefly discuss frequency of sound in relation to the wavelength.

[4 marks]

(b) With the help of a sketch diagram, define Noise Level (Phone)

[6 marks]

(c) A noise monitoring exercise has produced the following data:

Time (minutes)	Sound Pressure dB (A)
10	84
20	76
30	74
40	75
50	74
60	75

(i) Determine the value of L_{10} and L_{90}.

[6 marks]

(ii) Calculate the average Sound Power Level using formula.

[4 marks]

4. (a) Differentiate between Sound Intensity and Sound Intensity Level.

[5 marks]

(b) Calculate the sound pressure in kg/ms^2 released by a noise of 95 dB.

[5 marks]

(c) Explain the influence of ground absorption in noise reduction.

[5 marks]

(d) Calculate the Leq (60 minutes) from the following monitoring data:

Time (minutes)	Sound Pressure dB (A)
10	89
20	81
30	79
40	80
50	79
60	80
70	77
80	78
90	60
100	65
110	80
120	72

[5 marks]

5. (a) Explain the approach used for classification of hazardous wastes in Malaysia.

[10 marks]

(b) Categorize major classes of clinical wastes and prepare the management plan.

[10 marks]

6. (a) There are many types of methods used to treat industrial hazardous waste. Choose any TWO (2) sets of the following methods and differentiate between each of them:

(i) Pyrolysis and Gasification

(ii) Wet air oxidation and Supercritical water oxidation

(iii) Pervaporation and Adsorption

[10 marks]

(b) Briefly, explain the characteristic of palm oil mill wastewater. Suggest and discuss a flow diagram for the treatment of palm oil mill wastewater.

[10 marks]

1. (a) *Senaraikan kesemua pencemar udara utama yang dipantau oleh Jaringan Pemantauan Kualiti Udara Berterusan di Malaysia. Nyatakan nilai volumetrik dan gravimetrik yang bersamaan dengan nilai API 100*

[5 markah]

(b) *Gambarkan hubungan di antara garispusat geometrik dan bilangan pencemar zarah di dalam satu ispadu udara. Tentukan perbezaan mod berdasarkan saiz*

[4 markah]

(c) *Jelaskan secara ringkas pembentukan ozon dalam udara.*

[5 markah]

(d) *Keperluan untuk pemodelan pencemar udara semakin penting di Malaysia. Sekiranya satu projek baru dicadangkan di Bukit Tambun bagi membangunkan kawasan perindustrian dengan keluasan sekitar 300 hektar (3 km^2), terangkan mengapa pemodelan pencemar udara perlu dijalankan*

[6 markah]

2. (a) *Kirakan kepekatan gas sulfur dioksida (SO_2) (dalam μgm^{-3}) pada permukaan tanah di satu kawasan 5 kilometer di bawah aruhan angin dalam cuaca <u>mendung berawan</u> dari serombong sebuah stesen janakuasa bahanapi arang batu setinggi 100 m, jika arang batu dibakar pada kadar 5000 tan sehari. Arang batu tersebut mengandungi 1.4% sulfur. Ketinggian pelepasan efektif serombong ialah 214 m, dan halaju angin pada hujung serombong adalah 11.2 ms^{-1}.*

[7 markah]

(b) *Untuk menganggarkan kapasiti penjerapan praktikal atau dinamik, seseorang perlu mengetahui fenomena penjerapan pada keseimbangan. Secara ringkas, terangkan bagaimana kajian fenomena penjerapan pada keseimbangan dijalankan.*

[6 markah]

(c) *Loji janakuasa 2100-Megawatt Manjung, yang berada di Seri Manjung, Perak, direkabentuk untuk membakar arang batu yang mempunyai kandungan sulfur 1.25%. Laju aliran gas serombong yang keluar dari loji janakuasa ini ialah 765 kmol/min (pada 413 K dan 1 atm) dan gas serombong ini mengandungi 957 ppm SO_2. Gas serombong ini akan dirawat menggunakan penggahar batu kapur yang terdiri daripada 95% $CaCO_3$ dan 5% bahan lengai. Dengan andaian stoikiometri keseluruhan berikut ini digunakan untuk batu kapur.*

$CaCO_3 + SO_2 + 2H_2O \rightarrow CaSO_3.2H_2O + CO_2$
(AW: Ca = 40 kg/mol; C = 12 kg/mol; O = 16 kg/mol;
S = 32 kg/mol; H = 1 kg/mol)

Jika lebih batu kapur sebanyak 15% digunakan untuk menghapuskan SO_2 sebanyak 90%, kirakan kelajuan umpan batu kapur (dalam tan/hari) yang diperlukan.

[7 markah]

3. (a) *Secara ringkas bincangkan frekuensi bunyi berbanding dengan jarak gelombang.*

[4 markah]

(b) *Dengan bantuan lakaran, berikan definisi Paras Bunyi (Phon)*

[6 markah]

(c) *Suatu pemantauan bunyi menghasilkan data berikut:*

Masa (minit)	***Tekanan Bunyi dB (A)***
10	*84*
20	*76*
30	*74*
40	*75*
50	*74*
60	*75*

(i) *Tentukan nilai L_{10} dan L_{90}.*

[6 markah]

(ii) *Kirakan nilai purata Paras Kuasa Bunyi menggunakan formula.*

[4 markah]

4. (a) *Bezakan di antara keamatan bunyi dan Paras Keamatan Bunyi.*

[5 markah]

(b) *Kirakan tekanan bunyi dalam kg/ms^2 yang dihasilkan oleh bunyi 95 dB.*

[5 markah]

(c) *Terangkan pengaruh penyerapan bumi dalam pengurangan bunyi.*

[5 markah]

(d) *Kirakan Leq (60 minit) dari data pemantauan di bawah:*

Masa (minit)	***Tekanan bunyi dB (A)***
10	*89*
20	*81*
30	*79*
40	*80*
50	*79*
60	*80*
70	*77*
80	*78*
90	*60*
100	*65*
110	*80*
120	*72*

[5 markah]

5. *(a) Huraikan pendekatan kriteria untuk pengelasan sisa berbahaya di Malaysia.*

[10 markah]

(b) Apakah kelas-kelas utama sisa klinikal? Bagaimanakah mereka diuruskan?

[10 markah]

6. *(a) Ada banyak jenis kaedah yang digunakan untuk merawat bahan buangan berbahaya industri. Pilih sebarang DUA (2) set kaedah berikut dan bezakan antara masing-masing:*

(i) Pirolisis dan Penggasan
(ii) Pengoksidaan udara basah dan Pengoksidaan air supergenting
(iii) Pervaporasi dan Penjerapan

[10 markah]

(b) Secara ringkas, terangkan ciri-ciri air sisa kilang kelapa sawit. Cadangkan dan bincangkan carta aliran untuk mengolah air sisa kilang kelapa sawit.

[10 markah]

Appendix

Lampiran

Useful formulae:

1) $C = 20.05\ T^{0.5}$

2) $I = w/s$

3) $L_I = 10 \log_{10} I/10^{-12}$

4) $Lp = 20 \log_{10} (P/Po)$, $Po = 20\ \mu Pa$

5) $Lw = 10 \log_{10} (w/10^{-12})$

6) $Leq = 10 \log_{10} \sum ti\ 10^{\ Li/10}$

7) $L_{wp} = 10 \log_{10} 1/N \sum 10^{\ (Lj/10)}$

8) $L_{pp} = 20 \log_{10} 1/N \sum 10^{\ (Lj/20)}$

9) $T_L = 10\log10 \left\{ \dfrac{s}{\tau 1 s1 + \ldots. + \tau 2 s2} \right\}$

10) $T_L = 10 \log_{10} 1/\tau$

10) NNI = Average Peak Noise Level + $15 \log_{10} N - 80$
Average Peak Noise Level = $10 \log10\ 1/N \sum 10^{\ \text{Peak noise level } /10}$ dB (A)

11) Traffic Leq = $42.3 + 10.2 \log (Vc + 6\ Vt) – 13.9 \log D + 0.13\ S$

12) Traffic Ldn = $31.0 + 10.2 \log [AADT+ T\%\ AADT/20)] -13.9 \log D + 0.13\ S$

Appendix

Lampiran

Useful Formula

σ_z (kelas stabiliti C) = $0.08x\ (1 + 0.0002x)^{-0.5}$

σ_z (kelas stabiliti D) = $0.06x\ (1 + 0.0015x)^{-0.5}$

σ_z (kelas stabiliti F) = $0.016x\ (1 + 0.0003x)^{-1}$

σ_y (kelas stabiliti C) = $0.11x\ (1 + 0.0001x)^{-0.5}$

σ_y (kelas stabiliti D) = $0.08x\ (1 + 0.0001x)^{-0.5}$

σ_y (kelas stabiliti F) = $0.4x\ (1 + 0.0001x)^{-0.5}$

$$F_b = \frac{W_o . R_o^2 \quad g \quad (T_{po} - T_{ao})}{T_{po}}$$

$$q(x, y, z) = \frac{Q}{\pi \bar{u} \sigma_y \sigma_z} \exp\left[\frac{-H^2}{2\sigma_z^2}\right]$$

oooOOOooo